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ABSTRACT

Swedish research policy and organization, research areas, university research institutes, and international research and development (R&D) cooperation are discussed. Swedish research policy may be characterized as sectorized, decentralized, and pluralistic. The governmental bodies responsible for research direction include the Ministry of Education and research councils. One research area of special interest is research on environmental conservation and pollution abatement. Technical R&D has been assigned a high priority. Government funds are channeled to collective research (i.e., research programs that are jointly financed by private enterprise and the government). The universities are used as much as possible for research commissioned by the official sectoral bodies, and to some extent for research under contract to the business community. In addition, a number of independent, state-run research institutes exist. In the Swedish research system, the academies have an independent status in their traditional role as promotors of research and science in different disciplines. Sweden is involved in international teamwork for coordinated research programs. (SW)

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FACT
SHEETS
ON SWEDEN

RESEARCH PLANNING AND ORGANIZATION IN SWEDEN

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Fact Sheets on Sweden

Research Planning and Organization in Sweden

Sweden is sometimes described as a "mixed economy," i.e. a society in which responsibility for the production of goods and services is shared by the public and private sectors. As in most countries, the same division holds as regards responsibility for and financing of research and development (R&D).

On the one hand, the state or central government is responsible for its system of financing, planning and performing research; on the other hand, similar responsibilities are discharged by the private business community entirely within the framework of its own activities. At the same time the two systems meet on several levels and in various forms: through state support that is directly given to research performed by private industry, through research institutes that are jointly financed by the state and private industry, and through the state-run system of higher education which performs some R&D under contract to the business community.

For 1981 the total Swedish expenditures on R&D have been estimated at somewhat over SEK 12,000 million. Most of this amount, or ca. SEK 8,500 million, was spent in the business enterprise sector, SEK 800 million in the government sector and SEK 2,300 million in the higher education sector, while about SEK 450 million went to R&D performed abroad (SEK 150 million in foreign funds went to R&D in Sweden). R&D was mainly financed through funds from the business community (SEK 7,000 million) and the government (SEK 2,000 million). According to R&D statistics compiled by the OECD, the ratio of Swedish R&D in the business enterprise sector to the gross national product rose from about 1% to 1.5% during the period 1971–1981.

Research policy and organization

Swedish research policy may be characterized as (1) sectorized, (2) decentralized and (3) pluralistic.

Sectorization means that research is to be regarded as an instrument for achieving those goals which have been set up in different sectors: health, environmental protection, industrial development, education, defense, etc. The research inputs going into different sectors have to be weighed against other alternatives for achieving the goals of each sector.

Decentralization means that decisions implementing research policy are largely taken below Cabinet level, i.e. by the independent government agencies and by the research-performing organs or bodies.

Pluralism can be considered a corollary of the foregoing two principles; it means that research is financed through decisions taken in many different organs and that the research resources are channeled to those institutions which perform research.

Parliament concentrates its treatment of research matters on the allocation of R&D funds to different sectors and to institutions of higher education, i.e. the universities and colleges. Its decisions in this field are drafted by the standing committees, and research questions are referred to those committees which are designated to deal with particular societal sectors.

However, Parliament also keeps in touch with research in other ways. In Sweden the Central Bank is a parliamentary organ, and in 1964 Parliament established a special research foundation, the Bank of Sweden Tercentenary Fund, to celebrate the Central Bank's 300th anniversary. The Fund is administered by a Parliament-appointed board whose majority consists of MPs. Each year about SEK 40 million is available for making grants. The Fund has particularly concentrated on the social sciences.

To promote contact between legislators and scientists as well as dissemination of information about research within Parliament, an association known as RIFO has been attached to Parliament and receives support from public funds. RIFO plays no role in Parliament's decision-making processes, however.

The sector principle mentioned above marks the work devoted to research matters by the Government and the ministries, as well as the public administration. The system of government peculiar to Sweden, where often rather large, independent agencies work under relatively small ministries, has strongly affected the organizational form.

As in several other countries during the 1960s, a central organ was attached to the Government to advise on research matters. This body, the Government Research Advisory Board, which was recently reorganized, is chaired by the Deputy Prime Minister. The Board acts as a forum for consultations that take place between government spokesmen and persons representing the research community on the long-term aims of Swedish research policy.

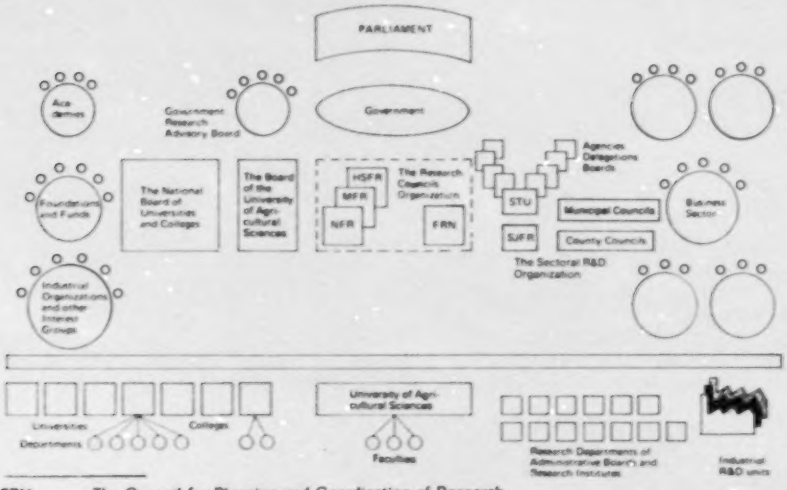
The fact that the Swedish R&D system is highly specialized and sectorized has called for measures to coordinate research policy and to make a survey of the system. In 1977 a government commission of inquiry proposed that the Government regularly, every third year, should present to Parliament an R&D program containing recommendations on questions of principle, a statistical presentation of Swedish R&D and a planning framework for future decisions. In accordance with this proposal the first overall R&D program was presented as a government bill to Parliament in 1982. Among other things the bill identified a number of priority areas for R&D, for example research necessary to form a basis for future technologies, research related to social and health problems and research in the social sciences and the humanities. The next bill will be presented in 1984.

The Ministry of Education and the research councils

The responsibility for most higher education and for those research councils which fund basic research gives the Ministry of Education its special role. However, since the fall of 1982 the responsibility for coordination of research policy lies with the Deputy Prime Minister and with the office of the Prime Minister.

Since 1977 there is a new research council organization with three research councils: the Council for Research in the Humanities and Social Sciences (HSFR), the Medical Research Council (MFR) and the Natural

The Swedish R&D system in simplified form. Planning, initiating and controlling organs (above). The R&D performing organization (below).



FRN = The Council for Planning and Coordination of Research
HSFR = The Council for Research in the Humanities and Social Sciences
MFR = The Medical Research Council
NFR = The Natural Science Research Council
SJFR = The Council for Forestry and Agricultural Research
STU = The Swedish Board for Technical Development

Science Research Council (NFR). A coordinating R&D organ, the Council for Planning and Coordination of Research (FRN), has also been set up. FRN is parallel to the councils and cooperates with them and with sectoral research bodies to initiate and finance joint projects in research areas of great social importance. FRN was instrumental in preparing the background for the government bill on R&D policy that was sent to Parliament in 1982.

The research councils largely consist of scientists appointed by academic electoral assemblies, but a small number of them represent sectoral research organs. In contrast, a majority of FRN members are representatives of the public interest.

In 1980 the Secretariat for Futures Studies was attached to FRN, which means that the Secretariat and the Committee for Future-Oriented Research are now under the same purview.

Also of research council character is the activity pursued by the Swedish Cancer Society. The Society, which is backed by trade unions, political parties and non-profit associations, grants support to cancer research. Although its operations are financed for the most part out of private donations, it also receives a smaller state subsidy from the Ministry of Education.

The dissemination of information about R&D results is of course essential to Swedish science and technology policy. In 1979 a special government body, the Delegation for Scientific and Technical Information (DFI), was set up to coordinate activities in this field.

Some R&D areas of special interest

As mentioned above, the sectoral research starts out from the societal needs that are identified in different areas. It follows that the division into "sectors," on which the sectoral research organization is based, is decided by a series of political, administrative and research-related factors. The bodies called upon to plan, initiate and finance R&D projects are of varying character. Some belong to the group of government agencies vested with direct authority in different areas; included in this category are the National Board of Health and Welfare, the National Board of Education, the National Board of Universities and Colleges and the National Board of Occupational Safety and Health. Others perform tasks which are limited to R&D but enjoy the status of autonomous government agencies; this category includes the Board for Technical Development, the Council for Building Research, the National Defense Research Institute, the Council for Forestry and Agricultural Research (SJFR) and the Delegation for Transportation Research. A third category comprises those organs which are more closely affiliated with their respective ministries; among the bodies which can be thus classified are the Delegation for Social Research, the Expert Group on Research on Housing, Building and Planning, and the Energy Research and Development Commission.

In response to the worldwide concern over pollution and other ecological problems that built up during the 1960s, the Swedish authorities set up a separate agency in 1967, the National Environment Protection Board, which was vested with overall responsibility for the external physical environment. Closely affiliated with the Board but enjoying independent decision-making authority is a research committee, which in fiscal 1982/83 had at its disposal about SEK 43 million for pollution abatement research.

The National Environment Protection Board is not the only body which sponsors research on environmental conservation and pollution abatement, as such research cuts across several societal areas. Responsibility for various aspects of environmental research is also borne by the Board for Technical Development, the Council for Building Research, the Council for Forestry and Agricultural Research and the Natural Science Research Council.

Problems of the environment also come under the purview of the Work Environment Fund (ASF), which was formed in 1972 to support any research, training and information that can guard against the risks of occupational injuries and other malaise originating in the job environment, or that can improve this environment and in that way promote occupational health and safety. ASF is partly financed out of payroll taxes. Working in close partnership with the National Board of Occupational Safety and Health, ASF is headed by a board whose membership is dominated by the labor market parties. ASF has concentrated its efforts on accident research, chemical health hazards and the scheduling of hours of work. In 1976 its purview was widened to take in research regarding the individual's problems in the job world and the connected problems of work structuring and co-determination or participatory management. This function of ASF is linked to the reformation of labor legislation in Sweden. As a base for R&D in support of labor law reforms, a special body, the Swedish Center for Working Life, has been established.

As part of the Swedish international development cooperation program, increased assistance is also being given to development research. Part of this assistance is channeled through R&D programs sponsored by international development cooperation agencies and part on a bilateral basis to different development projects. Since 1975 the body responsible for R&D in this field is the Swedish Agency for Research Cooperation with Developing Countries (SAREC), which is administratively linked to the Swedish International Development Authority (SIDA).

Even though social issues have been given increased attention in sectoral R&D, efforts in technical R&D still command a high and apparently, according to the latest developments, increasing priority. Responsibility for supporting technical R&D rests with the Swedish Board for Technical Development (STU), which in fiscal 1982/83 had a considerably increased budget amounting to about SEK 600 million. STU has three main functions: (1) to foster the growth of different societal sectors by drawing upon available or new technology; (2) to improve industry's innovation level and technical quality; (3) to elevate the scientific level and increase knowledge within the technical research areas. In 1978 Parliament decided on new guidelines for STU, which meant that tasks 1 and 2 are combined in a program for technical development, and general technical research is supported within the framework of a separate program.

An important aspect of STU's responsibility is to channel government funds to "collective research," i.e. the research institutes or research programs which are jointly financed by private enterprise and the government. About one fourth of STU's total support goes toward this collective research. Industry-wide research associations are found in the following fields, among others: food preservation, corrosion, nonferrous metals, water and air protection, textiles and forest products. STU accounts for about 10% of Sweden's total expenditures on technical development.

There are also national and regional development funds which lend money to manufacturers to help them with risk capital for projects intended to develop new products and industrial processes.

Following the energy crisis of the early 1970s, Sweden started improving and intensifying R&D efforts in this field. Funds amounting to SEK 1,400 million have been earmarked for the three-year program starting in fiscal 1981/82. Since energy is a sub-

1 Swedish krona (SEK) = US $0.13 or £0.09 (approx.)

ject that affects many societal sectors, special measures have been taken to keep the program coordinated. The Board for Technical Development, the Council for Building Research, the Delegation for Transportation Research and the Board for Energy Source Development are responsible for different parts of the program which is coordinated by the Energy R&D Commission. In addition, special funds have been allotted to the Natural Science Research Council for undertaking efforts in this field. Even though the program comes under the responsibility of several ministries, the responsibility for implementation is under the Ministry of Industry. As of July 1, 1983, energy R&D will be planned and coordinated by a new body, the National Energy Administration.

Sweden's policy of non-participation in alliances is coupled with an active defense policy. A massive R&D program is carried on under the aegis of the armed forces, and the costs of defense research form a substantial portion (close to 20%) of the government's total commitment to R&D. Expenditures have been particularly heavy in the field of air force technology. The National Defense Research Institute (FOA), which is the principal defense research organ in Sweden, works in close collaboration with other agencies involved in the total defense. Due to its considerable planning responsibility, FOA undertakes projects of a broader scope than those which ordinarily devolve on a research institute.

Universities, colleges and research institutes

The organization of higher education, which in Sweden is government-financed, plays a key role in the Swedish research system, not only because the universities and colleges form the traditional base for the training of researchers (graduate study) and long-term, intradisciplinary research of importance, but also because the universities are used as far as possible for research commissioned by official sectoral bodies and to some extent for research under contract to the business community.

Falling under the purview of the Ministry of Education are the six universities in Uppsala, Lund, Göteborg, Stockholm, Umeå and Linköping. Fixed resources for research and graduate study are also put at the disposal of the school of medicine in Stockholm (Karolinska Institutet) and the institutes of technology in Stockholm, Göteborg and Luleå. Programs of research and graduate study are also pursued at the Stockholm School of Economics and Business Administration, which is a private educational establishment with state support, at certain larger teacher-training colleges and the College of Physical Education in Stockholm.

The Ministry of Agriculture is responsible for the University of Agricultural Sciences, which incorporates an agricultural college, a college of forestry and a veterinary college.

The institutions of higher education under the Ministry of Education are administered by the National Board of Universities and Colleges (UHÄ). This agency is responsible for integration and overall planning of higher education at national level, with respect both to undergraduate and graduate studies. UHÄ's planning is especially important for the long-term orientation of research. The mechanisms involved are firstly the establishment of tenured research grants and the distribution of additional funds. The planning work is conducted by five planning committees whose members represent not only research and education but also trade unions, interest organizations, government agencies and the business community. UHÄ is presently trying to assess the needs for long-term oriented research as they are perceived by the sectoral bodies. This assessment will be presented to the Government as a document to be considered in the next bill to Parliament on R&D policy.

It emerges from the foregoing account that the universities are not so autonomous as in many other countries. It should, however, be emphasized that the concrete research projects are planned in the universities within the framework of their own resources or in interaction with research councils, sectoral organs or other external financiers. The responsibility for research planning within the universities is concentrated in their departments. The 700 or so university departments enjoy considerable autonomy and, subject only to defined constraints, are left free to allocate resources and to lay down the aims and structure of their research programs.

As part of the recent reform of higher education, measures have been taken to improve the conditions for a more coherent research planning within the universities. Among other things, special small-scale bodies have been set up to deal with matters of planning and appropriations within the various faculty areas.

The staff list in higher education now numbers about 2,200 posts for research, financed by the establishments out of their own budgets. In addition, there is a fluctuating number of researchers who are more loosely associated with the establishments, their salaries being paid out of funds which are made available from external sources.

It stands to reason that a substantial part of the university research is performed by that group of researchers who are enrolled in graduate study. There are about 12,800 persons in this group. It should be noted, however, that many members of the group have only a minor study and research activity. No more than about 700 persons per year receive PhDs or similar degrees after completing graduate study, which in principle runs for four years. A decrease in the number of PhD degrees and a slowdown in enrollment have given rise to a concern about future difficulties especially in the fields of the natural and social sciences.

There is a connection between undergraduate study and research: in principle, all education above secondary level is supposed to be based on research. Another important element of the recent reform is the strong emphasis on the responsibility of the universities to disseminate information about research and research results to society at large. Representatives for the public interest sit on the university boards as well as on the six regional boards that have been set up to coordinate and plan undergraduate education within their respective geographic areas.

The Swedish aspirations to draw wherever possible on the universities and colleges in satisfying society's research needs are based on a desire to avoid creating independent, totally state-run research institutes unless there are compelling reasons. Even so, a number of such institutes do exist and new ones are added at infrequent intervals. Here the most notable example is the National Defense Research Institute (FOA) dating from 1945; it is the country's largest research establishment with about 1,400 employees.

Building research is the province of an institute now located in Gävle. In Linköping there is another institute specifically devoted to transport engineering.

Studsvik Energiteknik (formerly AB Atomenergi), which is organized as a state-owned company performs a substantial amount of R&D related to energy. Up to now the company has chiefly focused on supporting R&D efforts in the nuclear power field, but during the past few years the activities have become broader in scope. Under the heading of natural sciences also fall the Institute for Atomic Physics and the Kiruna Geophysical Institute.

In the sphere of social issues, there is the Swedish Center for Working Life, and also the Institute for Social Research (SOFI), whose research is chiefly concerned with issues of social welfare policy and labor market policy.

Of special interest is the Stockholm International Peace Research Institute (SIPRI), which is independent of the Swedish government, that does no more than cover the costs of its operations. SIPRI's management and research staff are internationally recruited.

In addition, there are investigative laboratories and research departments which serve government agencies, for instance in the fields of environmental protection and food products.

Academies

In the Swedish research system the academies enjoy an independent status in their traditional role as promotors of research and science in different disciplines. They work by running their own research stations—albeit as yet on a limited scale compared with academies in several other countries, by organizing conferences and symposia, by publishing periodicals, by making and maintaining international contacts, and by pursuing studies and making proposals on their own to act as prime movers on matters of research policy.

The Royal Academy of Sciences (KVA), perhaps best known abroad for its designation of the Nobel laureates in chemistry and physics, was founded in 1739. Although its activity is largely based on private donations, KVA now receives annual government subsidies.

The Swedish Academy of Engineering Sciences (IVA) is likewise a private but state-supported organization. It also receives support from Swedish industry. Like KVA, IVA operates an extensive international contact network.

In addition to these academies there are the Royal Academy of Agriculture and Forestry and the Royal Academy of Letters, History and Antiquities.

Private foundations

There are also private research-supporting foundations. The possibility of financing research projects at universities and colleges through grants from private foundations greatly contributes to the pluralism which marks the Swedish research system. To no small extent, moreover, equipment for university research has been donated by private foundations.

Industrial research

In spite of economic problems affecting Swedish industry since the latter part of the 1970s, with decreasing exports and investments and receding profitability, R&D activity increased. The inputs in R&D have in fact increased since 1969, but the rate of

increase in real terms was diminishing until this downward trend was broken in 1981 when the volume of research expressed in man years increased by 6%.

Two aspects of industrial R&D should be pointed out in particular: the high level of internally generated financing and the concentration in selected branches of manufacturing. In 1981, the latest year for which R&D statistics are available, 89% of the industrial R&D was self-financed. However, this percentage has significant variations from one industry to another (see the table).

The R&D intensity varies sharply from industry to industry. This intensity (defined as the ratio of R&D costs to value added by manufacture) is highest, indeed exceptionally high, in the pharmaceutical industry, with the manufacture of transport equipment and of electrical machinery and equipment coming next. As of 1981 the transport equipment industry (excluding shipyards), the electrical equipment industry, the machine-making industry and the pharmaceutical industry accounted for 76% of the R&D outlays in mining and manufacturing.

The externally financed portion of industrial R&D comes almost exclusively from public funds; here a substantial part is attributable to orders placed by the armed forces. Another important aspect of state support to industrial R&D is a system of tax deductions for industrial R&D costs.

International R&D cooperation

Sweden accounts for roughly 1% of the world's total expenditures on R&D. Thus Sweden is extremely dependent on contacts with other countries in research matters.

R&D cooperation between the Nordic countries (Denmark, Finland, Iceland, Norway and Sweden) forms an important part of the endeavors to enlarge and deepen the scope of Nordic cooperation in general. Here the central bodies are the Nordic Council and the Nordic Council of Ministers. Under the aegis of Nordic cooperation a separate agreement has been reached which calls for working together in the cultural sphere. A number of research activities are financed under this agreement. By way of example there are the Nordic Institute for Theoretical Atomic Physics, the Central Institute for Nordic Research on Asia, the Joint Nordic Committee for International Politics, etc.

Working in the technological sphere is the Scandinavian Council for Applied Research (Nordforsk), which consists of representatives from the national organs concerned, in Sweden's case the Board for Technical Development and the Academy of Engineering Sciences. Nordforsk tries to bring about concrete projects of collaboration between the Nordic countries based on joint financing channeled through national R&D supporting organs. In 1973 a special Nordic industry fund was set up which receives appropriations from government budgets of the member countries. The fund is called upon to support technical R&D with an industrial thrust, for example in the fields of environmental protection, transportation, data processing and energy. The research councils and a number of sectoral R&D organs are represented on joint Nordic committees dedicated to the general exchange of information and the promotion of common activities. Several joint research institutes have been established.

Current and capital expenditures on R&D by industry division, 1981

Industry division	Total current and capital expenditures (in SEK million)	Self-financing (%)	Ratio of R&D to value added (%)
Mining	59	75	4.9
Food processing, etc.	147	95	1.8
Textiles, etc.	35	100	1.3
Lumber and wood products	23	87	0.6
Pulp and paper	294	97	2.3
Printing and publishing	15	100	0.2
Chemicals	235	98	6.3
Pharmaceuticals	567	98	35.8
Petroleum and coal	65	98	2.9
Rubber and plastics			
Porcelain and glass	15	97	1.6
Brick and cement	57	98	2.5
Basic metals, ferrous	332	96	6.0
Basic metals, nonferrous	63	97	3.2
Fabricated metal products	152	100	2.3
Machinery, excl. electrical	1,055	92	6.9
Electrical machinery, etc.	1,963	86	18.2
Shipbuilding	61	51	4.0
Transport equipment	1,790	81	16.1
Instruments, etc.	153	85	12.4
Other industries	6	100	1.7
All industries	7,087	89	7.2

Sweden is also heavily committed to fostering wider international cooperation than the Nordic. The research councils, especially in the fields of natural science and medicine, sit on joint committees with their Western European counterparts, and the Royal Academy of Sciences as well as FRN and all the research councils under the Ministry of Education are members of the European Science Foundation formed in 1974.

Much of the organized international research teamwork takes place in joint projects or coordinated research programs. Sweden is involved in a multitude of such programs. The biggest economic commitments are participation in CERN, the European organization for nuclear research, and in ESA, the European space research program. But considered from the national aspect, significant efforts are being made in other fields as well. Relevant examples are the cooperation between Sweden and Euratom, the commitment to the European molecular biology laboratory, EMBL, and the participation in COST, the European cooperation organization for technical R&D. In the field of basic research, Sweden, through the medium of the Natural Science Research Council, is also participating in EISCAT, a recently launched international project for the study of the upper atmosphere.

Over and above the foregoing, a number of organizations make arrangements for the exchange of research fellows, grant scholarships for the pursuit of research abroad, exchange information about research, etc.

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